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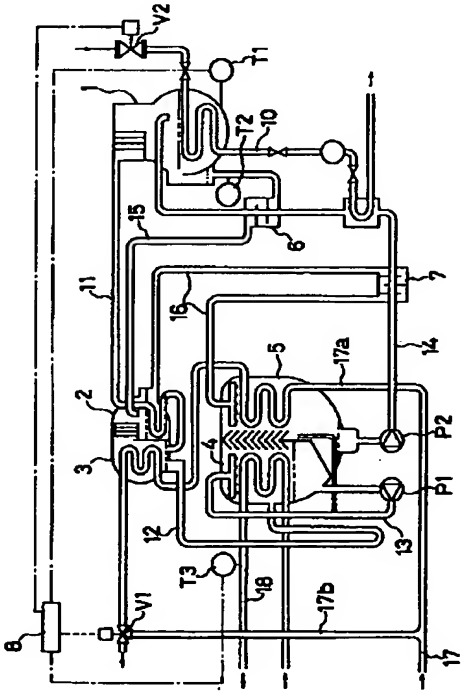
(54)【発明の名称】　吸収式冷凍機

(57)【要約】

【目的】　吸収式冷凍機の起動特性を向上させる。

【構成】　加熱用蒸気管１０を有する高温再生器１、低温再生器２、凝縮器３、蒸発器４、吸収器５、高温熱交換器６および低温熱交換器７を、冷媒蒸気管１１、冷媒液管１２、冷媒循環路１３、稀液管路１４、中間液管路１５、濃液管路１５が接続して冷凍サイクルを構成する吸収式冷凍機において、吸収器５および凝縮器３を通る冷却水管１７ａを有する冷却水管路１７に、三方弁Ｖ１を介してバイパス管１７ｂを接続し、起動運転時に、温度センサＴ１が検出する高温再生器１の吸収液温度に基づいて、三方弁Ｖ１の冷却水管１７ａ側開度を制御器８により漸増させる。



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【特許請求の範囲】

【請求項１】　再生器の熱源に蒸気あるいは温水を用いる吸収式冷凍機において、吸収器および凝縮器を迂回するバイパス管を三方弁を介して冷却水管路に接続し、再生器温度を検知して作動する制御器により、吸収式冷凍機の起動運転時に再生器温度の上昇に伴って、前記三方弁の吸収器および凝縮器側開度を漸増させ、バイパス管側開度を漸減させることを特徴とする吸収式冷凍機。

【請求項２】　再生器の熱源に蒸気あるいは温水を用いる吸収式冷凍機において、吸収器および凝縮器を迂回するバイパス管を三方弁を介して冷却水管路に接続し、再生器温度を検知して作動する制御器により、吸収式冷凍機の希釈運転時に再生器温度の低下に伴って、前記三方弁の吸収器および凝縮器側開度を漸減させ、バイパス管側開度を漸増させることを特徴とする吸収式冷凍機。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は吸収式冷凍機に関するものであり、特に詳しくは他機器の排熱（例えば、蒸気や温水）などを熱源とする再生器を備えた吸収式冷凍機の起動特性を改善する技術に関する。

【０００２】

【従来の技術】吸収式冷凍機の起動特性を向上させるためには、起動時の入熱を効率良く利用して吸収液を短時間で加熱濃縮し、冷媒蒸気を速やかに発生させることが有効であるとされており、冷却水の通水を起動時の一定時間、すなわち１０分程度停止して吸収液温度を急速に上昇させる方法が周知である。

【０００３】例えば、実公昭５６－５３２４０号公報には吸収器を構成する冷却水管に三方弁を介して側路管を設け、この三方弁を高温発生器の温度あるいは圧力または蒸発器下部の冷媒液面を検知して作動する制御器によって切り換え制御する構成の二重効用吸収冷凍機が開示されている。

【０００４】しかし、上記従来装置は、冷却水ポンプによる通水を冷凍機の起動に対して一定時間だけ遅延させると云う画一的な方法が採用されているに過ぎないため、運転停止が極めて短い場合には再起動時に吸収液が過濃縮状態となって結晶化したり、逆に長い運転停止の後の再起動では安定運転に入るまでの時間が期待した程短縮することができないと云った問題点があった。

【０００５】すなわち、図７に示したように、運転停止後短期間で再起動するＢ１の場合には、再生器の吸収液は例えば８０℃と云った高温度であるから、冷却水の供給を一定時間、例えば１０分間も停止させるとこの間に吸収液温度は安定運転時の温度１５０℃を遥かに越え、冷却水が供給されるときには１６０℃にも達して過濃縮状態となり、吸収液が結晶化すると云った最悪の事態に至る懸念がある。

【０００６】逆に、長い停止の後に運転を再開するＢ２

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の場合には、再生器の吸収液温度は５℃と云った低温にまで低下しているため、起動後１０分を経過しても吸収液はまだ６５℃に加熱されているに過ぎないので、この時点で冷却水の供給を開始すると吸収液の温度上昇は一段と緩くなり、安定運転に入る温度１５０℃に達するにはさらに２０分以上の長い時間が掛かると云った問題点がある。

【０００７】したがって、実機の制御においては吸収液の結晶化を避けることに重点が置かれることが多く、冷却水の通水停止時間を短めに設定して安全サイドで運転することになり、停止時間が長いときには再生器の温度上昇に一段と長い時間を要することから起動特性の充分な改善が図れていないと云った問題がある。

【０００８】また、上記従来装置は三方弁を単にオン／オフすることによって吸収器への冷却水供給を制御する構成であるから、再生器で加熱されて冷媒が蒸発する際に受けた潜熱を冷却水が吸収器に供給されるまでは冷凍能力の上昇に利用することができないため、冷凍能力は増加せず起動が遅れると云った欠点があり、また、三方弁を切り換えると冷却水の流量が急激に変化して冷却能力が大きく変動すると云った問題点もあった。

【０００９】

【発明が解決しようとする課題】したがって、本発明は再生器温度の如何に拘らず起動時間を短縮することが可能であり、かつ吸収液が過熱状態となって結晶化することのない吸収式冷凍機を提供しようとするものである。

【００１０】

【課題を解決するための手段】本発明は上記した従来技術の課題を解決するためになされたものであって、再生器の熱源に蒸気あるいは温水を用いる吸収式冷凍機において、吸収器および凝縮器を迂回するバイパス管を三方弁を介して冷却水管路に接続し、再生器温度を検知して作動する制御器により、吸収式冷凍機の起動運転時に再生器温度の上昇に伴って、前記三方弁の吸収器および凝縮器側開度を漸増させ、バイパス管側開度を漸減させることを特徴とする吸収式冷凍機であり、

【００１１】再生器の熱源に蒸気あるいは温水を用いる吸収式冷凍機において、吸収器および凝縮器を迂回するバイパス管を三方弁を介して冷却水管路に接続し、再生器温度を検知して作動する制御器により、吸収式冷凍機の希釈運転時に再生器温度の低下に伴って、前記三方弁の吸収器および凝縮器側開度を漸減させ、バイパス管側開度を漸増させることを特徴とする吸収式冷凍機である。

【００１２】

【作用】起動運転時においては、再生器温度の上昇に伴って三方弁の吸収器および凝縮器側開度が漸増し、バイパス管側開度が漸減するため、起動時の再生器温度が低い場合には冷却水の供給が抑制されて吸収液の加熱が促進され、起動時の再生器温度が高い場合には冷却水が多

く供給されて吸収液の過熱が防止される。

【００１３】運転を停止する際には、再生器温度の低下に伴って三方弁の吸収器および凝縮器側開度が漸減し、バイパス管側開度が漸増し、吸収器および凝縮器に供給される冷却水の量が再生器温度の低下に見合って減少するため、希釈不足や過希釈を起こす懸念がない。

【００１４】

【実施例】図１において、１は加熱用蒸気管１０が配管された高温再生器、２は低温再生器、３は凝縮器、４は蒸発器、５は吸収器、６は高温熱交換器、７は低温熱交換器であり、これらが冷媒蒸気管１１、冷媒液管１２、冷媒ポンプＰ１を有する冷媒循環路１３、吸収液ポンプＰ２を有する稀液管路１４、中間液管路１５および濃液管路１６により配管接続されて冷凍サイクルが構成され、

【００１５】吸収器５および凝縮器３を経由して配管された冷却水管１７ａを有する冷却水管路１７に、三方弁Ｖ１を介してバイパス管１７ｂが接続され、

【００１６】高温再生器１および低温再生器２においてそれぞれ稀液および中間液から蒸発分離され、凝縮器３で液化された冷媒液を利用することにより、蒸発器４を経由して配管された冷水管１８から冷水が取り出せるようになっている。

【００１７】そして、温度センサＴ１が高温再生器１の吸収液（中間液）温度が検出できるように設置され、この検出温度データに基づいて制御器８が前記三方弁Ｖ１の開度を制御するように接続されている。また、加熱用蒸気管１０に供給する高温蒸気の量を制御するために設置した加熱制御弁Ｖ２も、この制御器８によって制御できるように接続されている。

【００１８】なお、高温再生器１から中間液管路１５に吐出した吸収液（中間液）温度が検出可能に設置する温度センサＴ２を温度センサＴ１に代えて制御器８に接続し、前記三方弁Ｖ１の開度を制御する構成とすることも可能である。

【００１９】また、制御器８には冷水管１８の蒸発器４出口側に設置する冷水温度検出用の温度センサＴ３が接続され　この温度センサＴ３が検出する冷水温度に基づいて加熱制御弁Ｖ２の開度が制御され、高温再生器１における加熱量の制御が可能になっている。

【００２０】図２は制御器８の一構成例を説明するためのブロック図であり、温度センサＴ１（またはＴ２）が検出した高温再生器１の吸収液温度および温度センサＴ３が検出した冷水温度が、入力インターフェイス８１を介してＣＰＵ８２に入力され、ここで所定の演算処理が行われて、出力インターフェイス８３を介して三方弁Ｖ１と加熱制御弁Ｖ２の開度がそれぞれ制御できる構成となっている。

【００２１】そして、前記ＣＰＵ８２には、温度センサＴ１（またはＴ２）が検出した高温再生器１の吸収液温

度と三方弁Ｖ１開度との関係、例えば図３に示した制御関係式などの制御用プログラムを記憶したＲＯＭ８４と、温度センサＴ１などが検出した温度を一時記憶するＲＡＭ８５と、所定時間毎にタイム信号を発信するＣＬＯＣＫ８６とが接続されている。

【００２２】次に、起動運転時における冷却水制御、すなわち三方弁Ｖ１の制御例を図４に基づいて説明する。

【００２３】ステップＳ１で起動信号が入力されると、次のステップＳ２で温度センサＴ１が検出した高温再生器１の吸収液温度が入力される。

【００２４】運転停止状態にある吸収式冷凍機で起動スイッチが投入されると、閉の状態であった加熱制御弁Ｖ２が制御器８の指令によって開き、高温の蒸気が加熱用蒸気管１０を介して高温再生器１の内部を通過し、内部にある吸収液が加熱されて温度上昇が始まる。

【００２５】ステップＳ３ではＲＯＭ８４が記憶している高温再生器１の吸収液温度と三方弁Ｖ１との制御関係式、例えば図３を呼び出し、

【００２６】ステップＳ４において、呼び出した吸収液温度と三方弁Ｖ１との制御関係式からこの場合に必要な三方弁Ｖ１の冷却水管１７ａ側開度を演算して求め、

【００２７】この演算結果に基づいて、次のステップＳ５において三方弁Ｖ１の開度を制御する。

【００２８】ステップＳ６では、三方弁Ｖ１の冷却水管１７ａ側開度が１００％になっているか否かを判定し、１００％になっていれば起動時における冷却水量の制御を終了し、１００％になっていないときにはステップＳ２の前に戻り、所定時間後に再度高温再生器１の吸収液温度が入力されて、三方弁Ｖ１の開度制御が繰り返し実行される。

【００２９】例えば、ステップＳ２で入力された高温再生器１の吸収液温度が６５℃以下であるときには、ステップＳ３で呼び出した図３の制御関係式に基づいて、ステップＳ４で三方弁Ｖ１の冷却水管１７ａ側所要開度は０％（バイパス管１７ｂ側所要開度は１００％、以下この記載は省く）であると演算されるので、ステップＳ５において三方弁Ｖ１の冷却水管１７ａ側開度が０％に制御される。

【００３０】したがって、次のステップＳ６における開度判定ではＮＯの側に進んでステップＳ２の前に戻る。

【００３１】このように、高温再生器１の吸収液温度が６５℃以下であるときには、ステップＳ２からステップＳ６まで三方弁Ｖ１の開度制御を行っても、三方弁Ｖ１の冷却水管１７ａ側開度は増えないため、冷却水管１７ａを介して吸収器５および凝縮器３側に流入する冷却水量は増加することがないので、

【００３２】吸収器５から稀液管路１４に吐出して高温再生器１に流入する吸収液（稀液）は冷却されることがなく、しかも高温再生器１では加熱用蒸気管１０を流れる高温蒸気により加熱されるので、高温再生器１の吸収

液温度は急速に上昇する。

【0033】CLOCK86が所定時間（例えば、0.1秒）毎に発信するタイム信号に基づいて、例えば、5秒毎にステップS2からステップS6までの制御を繰り返す内に、高温再生器1の吸収液温度が上昇して例えば68℃に達すると、

【0034】ステップS4においてこのときの三方弁V1の冷却水管17a側所要開度は10%であると演算され、次のステップS5で三方弁V1の冷却水管17a側開度が10%に制御されるため、冷却水管17aを介して吸収器5および凝縮器3に冷却水が供給され始める。

【0035】この場合も次のステップS6における開度判定では、三方弁V1の冷却水管17a側開度は10%であるからNOの側に進みステップS2の前に戻る。

【0036】同様に、CLOCK86が発信するタイム信号に基づいて例えば5秒毎に、ステップS2からステップS6までの制御を繰り返し行い、その都度吸収液温度に基づく三方弁V1の冷却水管17a側所要開度をステップS4で演算し、ステップS5で冷却水管17a側開度を図3のように漸増させ、吸収器5および凝縮器3を経由する冷却水管17aに流す冷却水の量を増加させる。

【0037】そして、ステップS2からステップS6までの制御を繰り返す内に、高温再生器1の吸収液温度が上昇して例えば95℃以上に達すると、ステップS4では三方弁V1の冷却水管17a側所要開度が100%と演算されるため、ステップS5で冷却水管17a側開度が100%に制御され、冷却水管路17の冷却水は全て冷却水管17a側に流れて吸収器5および凝縮器3に流入し、バイパス管17bには全く流れなくなるため、冷水管18からは仕様通りに冷却された冷水が取り出し可能となる。

【0038】このように三方弁V1の開度が制御されると、次のステップS6の開度判定において冷却水管17a側の開度が100%であると判断され、YESの側のステップS7に進んで起動時における冷却水の供給制御が終了する。

【0039】以上説明したように、三方弁V1の冷却水管17a側開度を高温再生器1の吸収液温度に比例して制御する本発明の吸収式冷凍機においては、図6に示すように、短時間停止した後に再起動するA1の場合には高温再生器1の吸収液は例えば80℃と云った高温度であるから、冷却水の供給停止時間は僅か2．5分程度であり、この後すぐに供給が開始されるため15分程度で安定運転に入ることができ、しかも吸収液は過熱されないので過濃縮状態となったり結晶化すると云った懸念がない。

【0040】逆に、長い運転停止の後に再起動するA2の場合には、高温再生器1の吸収液温度は5℃と云った低温度になっているので、所定温度の65℃に達するまでの10分は冷却水の供給を全く停止して速やかな温度上昇を図り、65℃を越してからも冷却水を一挙に通水するのではなく、温度上昇に伴って漸増させるので、この場合も速やかに安定運転に入ることができる。

【0041】したがって、運転停止と起動のインターバルが長短いずれであっても速やかな起動が可能であり、起動特性が顕著に改善される。

【0042】しかも、三方弁V1の冷却水管17a側開度が高温再生器1の吸収液温度に基づいて比例的に制御される構成であるから、冷水管18から取り出す冷水温度の変動幅が小さく、このため冷却能力の変動が少ないと云った利点がある。

【0043】なお、高温再生器1の吸収液温度が所定温度に達していない場合にも、起動スイッチが投入されて所定時間、例えば60分が経過すると、三方弁V1の冷却水管17a側開度を100%にする制御プログラムをROM84に記憶させておき、この所定時間が経過すると温度センサT1などが検出する高温再生器1の吸収液温度の如何に拘らず、冷却水を吸収器5および凝縮器3に供給して運転を開始する構成とすることもできる。

【0044】次に、運転停止に至る希釈運転時の冷却水制御例について図5に基づいて説明する。

【0045】ステップS11で希釈運転信号が入力されると、次のステップS12で温度センサT1が検出した高温再生器1の吸収液温度が入力される。

【0046】運転状態にある吸収式冷凍機で停止スイッチが投入されると、開の状態であった加熱制御弁V2が制御器8の指令によって閉じられて高温再生器1における加熱が停止され、内部にある吸収液の温度低下が始まる。

【0047】ステップS13ではROM84が記憶している高温再生器1の吸収液温度と三方弁V1との制御関係式、例えば図3を呼び出し、

【0048】ステップS14において、呼び出した吸収液温度と三方弁V1との制御関係式からこの場合に必要な三方弁V1の冷却水管17a側開度を演算して求め、

【0049】この演算結果に基づいて、次のステップS15において三方弁V1の開度を制御する。

【0050】ステップS16では、三方弁V1の冷却水管17a側開度が0%になっているか否かを判定し、0%になっていれば希釈運転時における冷却水量の制御を終了し、0%になっていないときにはステップS12の前に戻り、所定時間後に再度高温再生器1の吸収液温度が入力されて、三方弁V1の開度制御が繰り返し実行される。

【0051】例えば、ステップS12で入力された高温再生器1の吸収液温度が95℃以上であるときには、ステップS13で呼び出した図3の制御関係式に基づいて、ステップS14で三方弁V1の冷却水管17a側所要開度は100%であると演算されるので、ステップS

１５において三方弁Ｖ１の冷却水管１７ａ側開度は変更されず、開度１００％が維持される。

【００５２】したがって、次のステップＳ１６における開度判定ではＮＯの側に進んでステップＳ１２の前に戻る。

【００５３】このように、高温再生器１の吸収液温度が９５℃以上であるときには、ステップＳ１２からステップＳ１６まで三方弁Ｖ１の開度制御を行っても、三方弁Ｖ１の冷却水管１７ａ側開度は減少しないため、冷却水管１７ａを介して吸収器５および凝縮器３側に流入する冷却水量は減少することがないので、

【００５４】吸収器５から稀液管路１４に吐出して高温再生器１に流入する吸収液の温度は急速に低下し、しかも高温再生器１には高温蒸気が流入しなくなっているので、高温再生器１の吸収液温度も速やかに低下する。

【００５５】ＣＬＯＣＫ８６が所定時間（例えば、０．１秒）毎に発信するタイム信号に基づいて、例えば、５秒毎にステップＳ１２からステップＳ１６までの制御を繰り返す内に、高温再生器１の吸収液温度が低下して例えば９２℃に達すると、

【００５６】ステップＳ１４においてこのときの三方弁Ｖ１の冷却水管１７ａ側所要開度が９０％であると演算され、ステップＳ１５で三方弁Ｖ１の冷却水管１７ａ側開度が９０％に制御されるため、冷却水管１７ａを介して吸収器５および凝縮器３に供給される冷却水の量が減少し始め、高温再生器１の吸収液の温度低下は緩やかになる。

【００５７】この場合も、ステップＳ１６における開度判定では三方弁Ｖ１の冷却水管１７ａ側開度は９０％であるからＮＯの側に進み、ステップＳ１２の前に戻る。

【００５８】同様に、ＣＬＯＣＫ８６が発信するタイム信号に基づいて例えば５秒毎に、ステップＳ１２からステップＳ１６までの制御を繰り返し行い、その都度吸収液温度に基づく三方弁Ｖ１の冷却水管１７ａ側所要開度をステップＳ１４で演算し、ステップＳ１５で冷却水管１７ａ側開度を図３のように漸減させ、吸収器５および凝縮器３を経由する冷却水管１７ａに流す冷却水の量を減少させる。

【００５９】そして、ステップＳ１２からステップＳ１６までの制御を繰り返す内に、高温再生器１の吸収液温度が低下して例えば６５℃以下になると、ステップＳ１４では三方弁Ｖ１の冷却水管１７ａ側所要開度が０％と演算されるため、ステップＳ１５で冷却水管１７ａ側開度が０％に制御され、

【００６０】冷却水管路１７の冷却水は全てバイパス管１７ｂに流れ、吸収器５および凝縮器３に配管された冷却水管１７ａ側には全く流れなくなるため、吸収器５から稀液管路１４に吐出して高温再生器１に流入する吸収液の温度低下はさらに小さくなり、したがって高温再生器１にある吸収液の温度低下は一層緩やかになる。

【００６１】このように三方弁Ｖ１の開度が制御されると、次のステップＳ１６の開度判定において冷却水管１７ａ側の開度が０％であると判断され、ＹＥＳの側のステップＳ１７に進んで希釈運転時における冷却水の供給制御が終了する。

【００６２】以上説明したように、高温再生器１の吸収液の温度低下に伴って三方弁Ｖ１のバイパス管１７ｂ側開度が漸増し、吸収器５および凝縮器３に配管された冷却水管１７ａ側開度が漸減し、吸収器５および凝縮器３に供給される冷却水の量が高温再生器１における吸収液の温度低下に見合って減少するため、希釈不足や過希釈を起こす懸念がない。

【００６３】なお、本発明は上記実施例に限定されるものではないので、高温再生器１の吸収液温度と三方弁Ｖ１の開度との制御関係式は適宜変更し得るものであり、また起動運転時の制御関係式と希釈運転時の制御関係式とは相違させることも可能である。

【００６４】

【発明の効果】以上説明したように本発明は再生器の熱源に蒸気あるいは温水を用いる吸収式冷凍機において、吸収器および凝縮器を迂回するバイパス管を三方弁を介して冷却水管路に接続し、再生器温度を検知して作動する制御器により、吸収式冷凍機の起動運転時に再生器温度の上昇に伴って、前記三方弁の吸収器および凝縮器側開度を漸増させ、バイパス管側開度を漸減させるものであるから、短期間の停止で再起動し、再生器温度が高い場合には冷却水が早くから供給されて過濃縮が防止されると共に速やかな運転が可能であり、長く停止して再起動したときには再生器温度は低温度になっているため、所定温度に達するまで冷却水の供給を遅らせるので加熱効率が高く、運転開始に至る迄の時間が短縮される。また、冷却水の供給が徐々に増加するため、冷却能力の変動が小さいと云った利点もある。一方、吸収式冷凍機の希釈運転時に再生器温度の低下に伴って、前記三方弁の吸収器および凝縮器側開度を漸減させ、バイパス管側開度を漸増させる吸収式冷凍機においては、再生器温度の低下に見合った量の冷却水が吸収器および凝縮器に供給されるため、希釈不足や過希釈を起こす懸念がない。

【図面の簡単な説明】

【図１】一実施例の構成を示す説明図である。

【図２】制御器の構成を示すブロック図である。

【図３】高温再生器の吸収液温度と三方弁開度との制御関係式である。

【図４】起動運転時の制御例を示す説明図である。

【図５】希釈運転時の制御例を示す説明図である。

【図６】吸収液の温度上昇カーブを示す説明図である。

【図７】従来装置による吸収液の温度上昇カーブを示す説明図である。

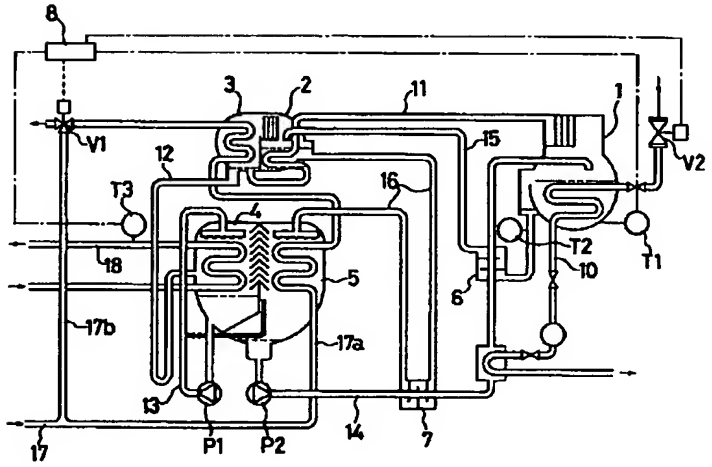
【符号の説明】

１　高温再生器

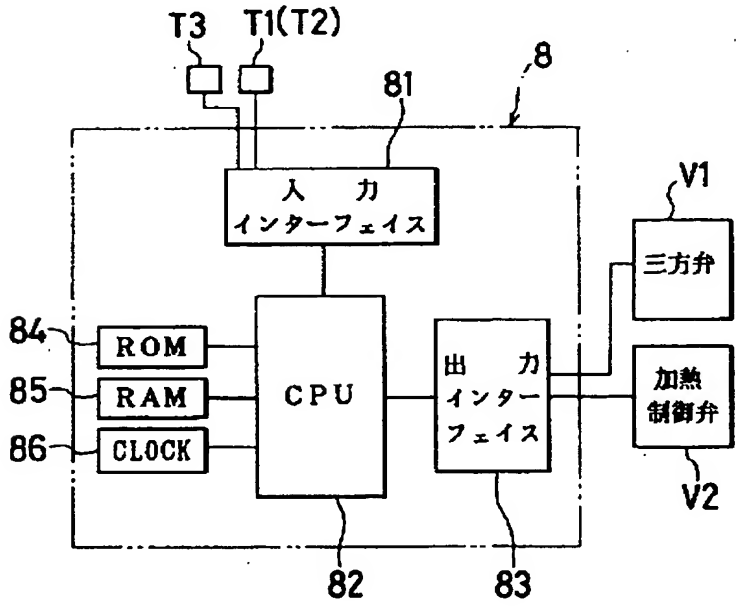
9　　10

2　低温再生器
3　凝縮器
4　蒸発器
5　吸収器
6　高温熱交換器
7　低温熱交換器
8　制御器
10　加熱用蒸気管
11　冷媒蒸気管
12　冷媒液管
13　冷媒循環路
14　稀液管路
15　中間液管路
16　濃液管路
17　冷却水管路
17a　冷却水管
17b　バイパス管
18　冷水管
V1　三方弁
V2　加熱制御弁
T1　T2　T3　温度センサ

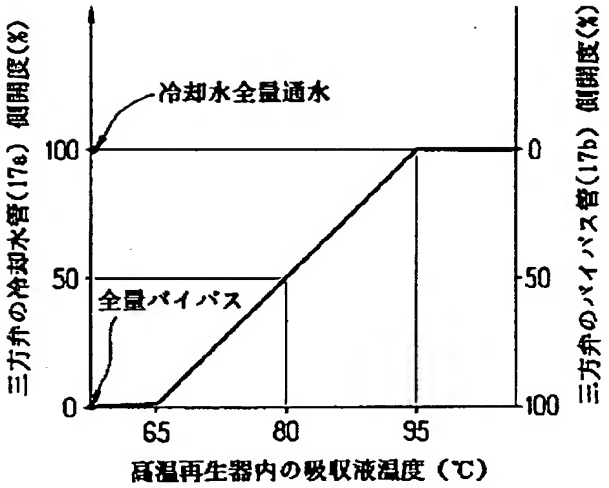
【図1】



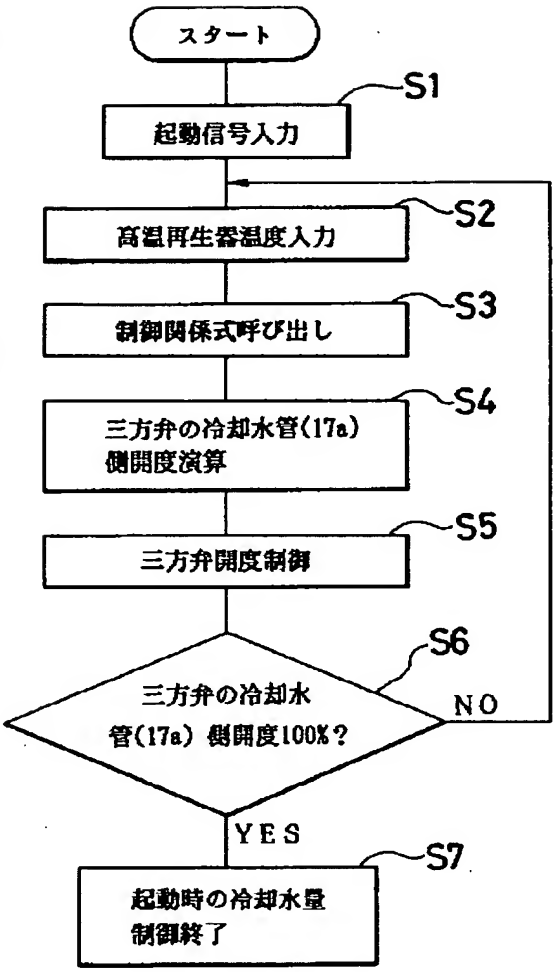
【図2】



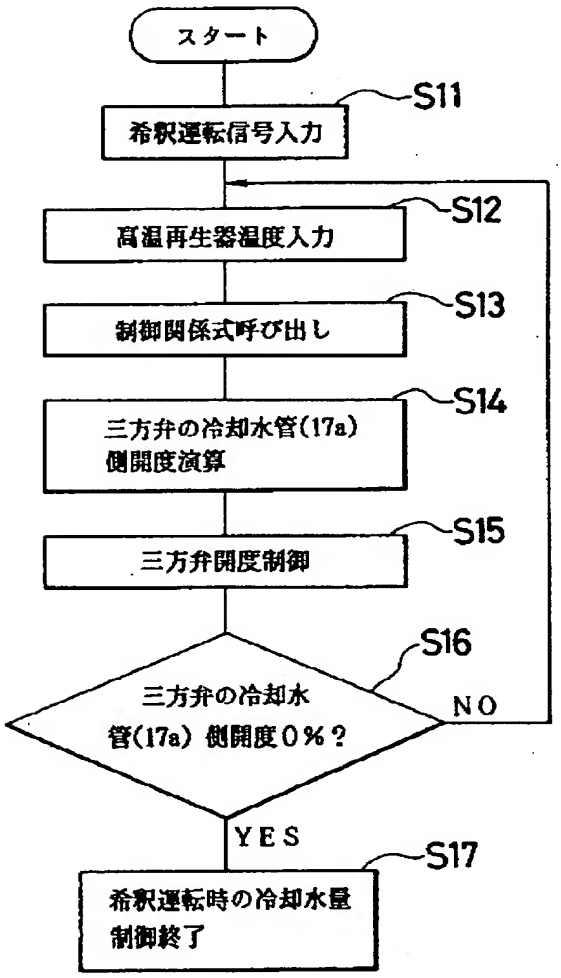
【図3】


三方弁の冷却水管(17a) 側開度(%)
三方弁のバイパス管(17b) 側開度(%)
冷却水全量通水
全量バイパス
100
50
0
65
80
95
高温再生器内の吸収液温度 (℃)

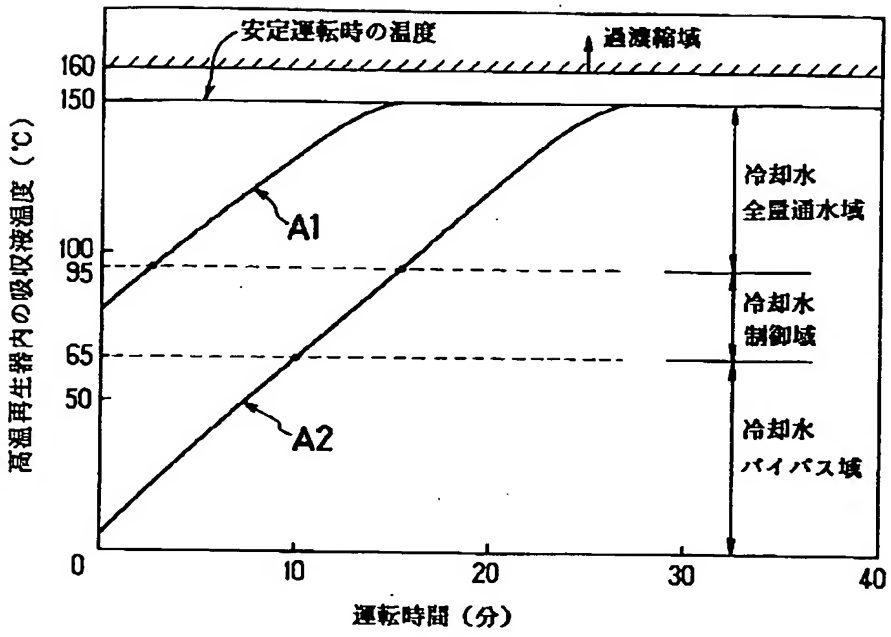
【図4】


スタート
S1
起動信号入力
S2
高温再生器温度入力
S3
制御関係式呼び出し
S4
三方弁の冷却水管(17a)
側開度演算
S5
三方弁開度制御
S6
三方弁の冷却水
管(17a) 側開度100%?
NO
YES
S7
起動時の冷却水量
制御終了

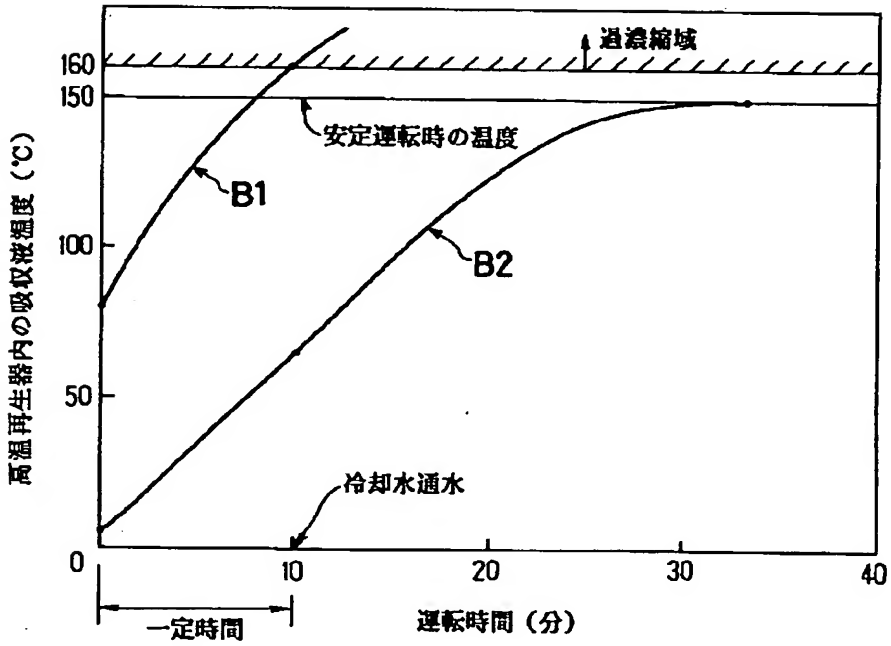
【図5】


スタート
S11
希釈運転信号入力
S12
高温再生器温度入力
S13
制御関係式呼び出し
S14
三方弁の冷却水管(17a)
側開度演算
S15
三方弁開度制御
S16
三方弁の冷却水
管(17a) 側開度0%?
NO
YES
S17
希釈運転時の冷却水量
制御終了

【図6】


安定運転時の温度
過濃縮域
160
150
100
95
65
50
0
A1
A2
冷却水
全量通水域
冷却水
制御域
冷却水
バイパス域
10
20
30
40
運転時間（分）
高温再生器内の吸収液温度（℃）

【図7】


過濃縮域
160
150
安定運転時の温度
B1
100
B2
50
冷却水通水
0
10
20
30
40
一定時間
運転時間（分）
高温再生器内の吸収液温度（℃）

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the technique of improving the starting performance of the absorption refrigerator equipped with the regenerator which makes a heat source especially exhaust heat (for example, a steam and warm water) of other devices etc. in detail, about an absorption refrigerator.
[0002]
[Description of the Prior Art] In order to raise the starting performance of an absorption refrigerator, heating concentration of the lean solution is carried out for a short time, using the heat input at the time of starting efficiently, to generate a refrigerant steam promptly is confirmed, and fixed time amount at the time of starting, i.e., the method of stopping about 10 minutes and raising whenever [absorption solution temperature] quickly, is common knowledge about water flow of cooling water.
[0003] For example, by-pass tubing is formed in cooling water tubing which constitutes an absorber in JP,56-53240,Y through a cross valve, and the double effect absorption chiller of a configuration of switching and controlling this cross valve by the controller which detects the refrigerant oil level of the temperature of a thermogenesis machine, a pressure, or the evaporator lower part, and operates is indicated.
[0004] however, the trouble referred to as being unable to shorten it conventionally [above-mentioned], so that time amount until a lean solution will be in rich contracted state, and crystallize at the time of a reboot or it starts stable operation in the reboot after conversely long shutdown expected equipment when shutdown is very short since [which does not boil too much] the uniform approach referred to as that only fixed time amount delays the water flow by the cooling water pump to starting of a refrigerator is adopted **ed .
[0005] namely, as shown in drawing 7 , in the case of B1 which reboots for a short period of time after shutdown Since the lean solution of a regenerator is the high temperature which it said was 80 degrees C, supply of cooling water Fixed time amount, For example, when for 10 minutes is stopped, when the temperature of 150 degrees C at the time of stable operation is exceeded far and cooling water is supplied, whenever [absorption solution temperature] will amount also to 160 degrees C, and will be in rich contracted state, and there is concern which results in the worst situation which said that a lean solution crystallized in the meantime.
[0006] on the contrary, in the case of B-2 which resumes operation after a long halt Since whenever [absorption solution temperature / of a regenerator] is falling even to the low temperature which it said was 5 degrees C and the lean solution is still heated by 65 degrees C even if 10 minutes after starting pass When supply of cooling water is started at this time, the temperature rise of a lean solution becomes loose much more, and has the trouble referred to as that reaching the temperature of 150 degrees C included in stable operation takes the long time amount for 20 more minutes or more.
[0007] Therefore, emphasis is put on avoiding crystallization of a lean solution in control of the system in many cases, the water flow stop time of cooling water will be set up shorter, and it will operate on an

insurance side, and since the temperature rise of a regenerator takes longer time amount when a stop time is long, there is a problem referred to as being unable to aim at sufficient improvement of a starting performance.

[0008] Moreover, conventionally [above-mentioned], since equipment is a configuration which controls the cooling water supply to an absorber by only turning on / turning off a cross valve Since it cannot use for the rise of refrigerating capacity until the latent heat received when it was heated with a regenerator and a refrigerant evaporated is supplied to cooling water by the absorber, When refrigerating capacity does not increase, but has the fault which said that starting was overdue and the cross valve was switched, the flow rate of cooling water also had the trouble referred to as changing rapidly and changing refrigeration capacity sharply.

[0009]

[Problem(s) to be Solved by the Invention] Therefore, regenerator temperature is not [how] scrupulous, and this invention can shorten warm-up time, and it is going to offer the absorption refrigerator which a lean solution will be in overheating and does not crystallize.

[0010]

[Means for Solving the Problem] In the absorption refrigerator which is made in order that this invention may solve the technical problem of the above-mentioned conventional technique, and uses a steam or warm water for the heat source of a regenerator Connect to a cooling water duct the by-path pipe which bypasses an absorber and a condenser through a cross valve, and regenerator temperature with the controller which detects and operates It is the absorption refrigerator characterized by making the absorber of said cross valve, and condenser side opening increase gradually with the rise of regenerator temperature at the time of starting operation of an absorption refrigerator, and dwindling by-path pipe side opening, and is [0011]. In the absorption refrigerator which uses a steam or warm water for the heat source of a regenerator, it is the absorption refrigerator characterized by dwindling the absorber of said cross valve, and condenser side opening with the fall of regenerator temperature at the time of dilution operation of an absorption refrigerator, and making by-path pipe side opening increase gradually with the controller which connects to a cooling water duct the by-path pipe which bypasses an absorber and a condenser through a cross valve, detects regenerator temperature, and operates.

[0012]

[Function] In order that the absorber of a cross valve and condenser side opening may increase gradually with the rise of regenerator temperature at the time of starting operation and by-path pipe side opening may gradually decrease, when the regenerator temperature at the time of starting is low, supply of cooling water is controlled, heating of a lean solution is promoted, when the regenerator temperature at the time of starting is high, many cooling water is supplied and overheating of a lean solution is prevented.

[0013] In case operation is suspended, the absorber of a cross valve and condenser side opening gradually decrease with the fall of regenerator temperature, by-path pipe side opening increases gradually, and in order that the amount of the cooling water supplied to an absorber and a condenser may balance the fall of regenerator temperature and may decrease, there is no concern which causes the lack of dilution and fault dilution.

[0014]

[Example] In drawing 1 , the steam pipe 10 for heating the high temperature regenerator with which 1 was piped, and 2 A low-temperature regenerator, For a condenser and 4, as for an absorber and 6, an evaporator and 5 are [3 / an elevated-temperature heat exchanger and 7] low-temperature heat exchangers. Piping connection is made by the refrigerant circuit 13 where these have the refrigerant steam pipe 11, the refrigerant liquid tube 12, and the refrigerant pump P1, the dilute solution duct 14 which has the lean-solution pump P2, the middle liquid tube way 15, and the dark liquid tube way 16, a refrigerating cycle is constituted, and it is [0015]. By-path pipe 17b is connected to the cooling water duct 17 which has cooling water tubing 17a piped via the absorber 5 and the condenser 3 through a cross valve V1, and it is [0016]. In a high temperature regenerator 1 and a low-temperature regenerator 2, evaporation separation is carried out from dilute solution and middle liquid, respectively, and cold water

can be picked out now from the cold-water tubing 18 piped via the evaporator 4 by using the refrigerant liquid liquefied with the condenser 3.
[0017] And it is installed so that a temperature sensor T1 can detect the lean-solution (middle liquid) temperature of a high temperature regenerator 1, and it connects so that a controller 8 may control the opening of said cross valve V1 based on this detection temperature data. Moreover, it connects so that the heating control valve V2 installed in order to control the amount of the elevated-temperature steam supplied to the steam pipe 10 for heating can also be controlled by this controller 8.
[0018] In addition, it is also possible to consider as the configuration by which the temperature sensor T2 installed possible [detection] is replaced with a temperature sensor T1, it connects with a controller 8, and the lean-solution (middle liquid) temperature breathed out on the middle liquid tube way 15 from the high temperature regenerator 1 controls the opening of said cross valve V1.
[0019] Moreover, temperature sensor T3 for cold-water temperature detection installed in evaporator 4 outlet side of the cold-water tubing 18 is connected to a controller 8. Based on the cold-water temperature which this temperature sensor T3 detects, the opening of the heating control valve V2 is controlled, and control of the amount of heating in a high temperature regenerator 1 is attained.
[0020] Drawing 2 is a block diagram for explaining the example of 1 configuration of a controller 8, and the cold-water temperature which whenever [absorption solution temperature / of the high temperature regenerator 1 which the temperature sensor T1 (or T2) detected], and, temperature sensor T3 detected is inputted into CPU82 through the input interface 81, here predetermined data processing is performed, and it has composition which the opening of a cross valve V1 and the heating control valve V2 can control through the output interface 83, respectively.
[0021] And ROM84 which memorized programs for control, such as control relational expression shown in the relation between whenever [absorption solution temperature / of the high temperature regenerator 1 which the temperature sensor T1 (or T2) detected], and cross valve V1 opening, for example, drawing 3 , RAM85 which stores temporarily the temperature which the temperature sensor T1 etc. detected, and CLOCK86 which sends a time signal for every predetermined time are connected to said CPU82.
[0022] Next, based on drawing 4 , the cooling water control at the time of starting operation, i.e., the example of control of a cross valve V1, is explained.
[0023] If a seizing signal is inputted at step S1, whenever [absorption solution temperature / of the high temperature regenerator 1 which the temperature sensor T1 detected at the following step S2] will be inputted.
[0024] If a start switch is supplied with the absorption refrigerator in a shutdown condition, the heating control valve V2 which was in the close condition will open by the command of a controller 8, the lean solution which a hot steam passes through the interior of a high temperature regenerator 1 through the steam pipe 10 for heating, and has it in the interior will be heated, and a temperature rise will start.
[0025] The control relational expression of whenever [absorption solution temperature / of the high temperature regenerator 1 which ROM84 has memorized at step S3], and a cross valve V1, for example, drawing 3 , is called, and it is [0026]. In step S4, it calculates and asks for the cooling water tubing 17a side opening of the cross valve V1 required in this case from the control relational expression of whenever [absorption solution temperature / which was called], and a cross valve V1, and is [0027]. Based on this result of an operation, the opening of a cross valve V1 is controlled in the following step S5.
[0028] At step S6, it judges whether the cooling water tubing 17a side opening of a cross valve V1 is 100%, if it is 100%, when ending control of the circulating water flow at the time of starting and having not become 100%, whenever [absorption solution temperature / of a high temperature regenerator 1] is again inputted after return and predetermined time before step S2, and opening control of a cross valve V1 is performed repeatedly.
[0029] for example, when whenever [absorption solution temperature / of the high temperature regenerator 1 inputted at step S2] is 65 degrees C or less step S3 -- call appearance, since it calculates that the cooling water tubing 17a side necessary opening of a cross valve V1 is 0% (the by-path pipe 17b

side necessary opening excludes this publication below 100%) in step S4 based on the control relational expression of drawing 3 the bottom In step S5, the cooling water tubing 17a side opening of a cross valve V1 is controlled to 0%.

[0030] Therefore, in the opening judging in the following step S6, it progresses to the NO side and returns before step S2.

[0031] Thus, since it does not increase, the circulating water flow which flows into an absorber 5 and condenser 3 side through cooling water tubing 17a in order for the cooling water tubing 17a side opening of a cross valve V1 not to increase, even if it performs opening control of a cross valve V1 from step S2 to step S6, when whenever [absorption solution temperature / of a high temperature regenerator 1] is 65 degrees C or less is [0032]. Since the lean solution (dilute solution) which breathes out from an absorber 5 to the dilute solution duct 14, and flows into a high temperature regenerator 1 is heated by the elevated-temperature steam which is not cooled and moreover flows the steam pipe 10 for heating with a high temperature regenerator 1, whenever [absorption solution temperature / of a high temperature regenerator 1] goes up quickly.

[0033] It is [0034], when whenever [absorption solution temperature / of a high temperature regenerator 1] goes up, for example, it amounts to 68 degrees C, while CLOCK86 repeats control from step S2 to step S6 every 5 seconds based on the time signal sent to every predetermined time (for example, 0.1 seconds). Since the cooling water tubing 17a side necessary opening of the cross valve V1 at this time calculates that it is 10% in step S4 and the cooling water tubing 17a side opening of a cross valve V1 is controlled by the following step S5 to 10%, cooling water begins to be supplied to an absorber 5 and a condenser 3 through cooling water tubing 17a.

[0035] Also in this case, in the opening judging in the following step S6, since the cooling water tubing 17a side opening of a cross valve V1 is 10%, it progresses to the NO side and returns before step S2.

[0036] Similarly it is based on the time signal which CLOCK86 sends. Every [for example,] 5 seconds Carry out by repeating control from step S2 to step S6, and the cooling water tubing 17a side necessary opening of the cross valve V1 based on whenever [absorption solution temperature] is calculated by step S4 each time. The cooling water tubing 17a side opening is made to increase gradually like drawing 3 at step S5, and the amount of the cooling water poured to cooling water tubing 17a which goes via an absorber 5 and a condenser 3 is made to increase.

[0037] And if whenever [absorption solution temperature / of a high temperature regenerator 1] goes up, for example, it amounts to 95 degrees C or more while repeating control from step S2 to step S6 In order that the cooling water tubing 17a side necessary opening of a cross valve V1 may calculate with 100% in step S4, In order the cooling water tubing 17a side opening is controlled by step S5 to 100%, and all the cooling water of the cooling water duct 17 flows to the cooling water tubing 17a side, and to flow into an absorber 5 and a condenser 3 and not to flow at all to by-path pipe 17b, The ejection of the cold water cooled as the specification becomes possible from the cold-water tubing 18.

[0038] Thus, if the opening of a cross valve V1 is controlled, it is judged that the opening by the side of cooling water tubing 17a is 100% in the opening judging of the following step S6, it will progress to the near step S7 of YES, and supply control of the cooling water at the time of starting will be completed.

[0039] In the absorption refrigerator of this invention which controls the cooling water tubing 17a side opening of a cross valve V1 in proportion to whenever [absorption solution temperature / of a high temperature regenerator 1] as explained above In the case of A1 which reboots after carrying out a short-time halt, as shown in drawing 6 , since the lean solution of a high temperature regenerator 1 is the high temperature which it said was 80 degrees C The supply interruption time amount of cooling water is a small 2.5 part grade, since supply is started immediately after this, stable operation can be started in about 15 minutes, and moreover, since it is not overheated, a lean solution does not have the concern referred to as being in rich contracted state or crystallizing.

[0040] on the contrary, in the case of A2 which reboots after long shutdown Since whenever [absorption solution temperature / of a high temperature regenerator 1] is whenever [low-temperature / which it said was 5 degrees C] Since they does not let cooling water flow at once but is made to increase it gradually in connection with a temperature rise also after 10 minutes until it amounts to 65

degrees C of predetermined temperature completely suspend supply of cooling water, plans a prompt temperature rise and exceeds 65 degrees C, stable operation can be promptly started also in this case.
[0041] therefore, the interval of shutdown and starting -- merits and demerits -- even if it is any, prompt starting is possible, and a starting performance is improved notably.
[0042] And since it is the configuration by which the cooling water tubing 17a side opening of a cross valve V1 is proportionally controlled-like based on whenever [absorption solution temperature / of a high temperature regenerator 1], the range of fluctuation of the cold-water temperature taken out from the cold-water tubing 18 is small, and there is an advantage which said that there was little fluctuation of refrigeration capacity for this reason.
[0043] In addition, if a start switch is supplied and predetermined time, for example, 60 minutes, passes also when whenever [absorption solution temperature / of a high temperature regenerator 1] has not reached predetermined temperature ROM84 is made to memorize the control program which makes 100% the cooling water tubing 17a side opening of a cross valve V1. If this predetermined time passes, whenever [absorption solution temperature / of the high temperature regenerator 1 which a temperature sensor T1 etc. detects] cannot be [how] scrupulous, and it can also consider as the configuration which supplies cooling water to an absorber 5 and a condenser 3, and starts operation.
[0044] Next, the example of cooling water control at the time of dilution operation which results in shutdown is explained based on drawing 5 .
[0045] If a dilution operation signal is inputted at step S11, whenever [absorption solution temperature / of the high temperature regenerator 1 which the temperature sensor T1 detected at the following step S12] will be inputted.
[0046] If a safety switch is thrown in with the absorption refrigerator in operational status, the heating control valve V2 which was in the open condition will,be closed by the command of a controller 8, heating in a high temperature regenerator 1 will be suspended, and the temperature fall of the lean solution in the interior will start.
[0047] The control relational expression of whenever [absorption solution temperature / of the high temperature regenerator 1 which ROM84 has memorized at step S13], and a cross valve V1, for example, drawing 3 , is called, and it is [0048]. In step S14, it calculates and asks for the cooling water tubing 17a side opening of the cross valve V1 required in this case from the control relational expression of whenever [absorption solution temperature / which was called], and a cross valve V1, and is [0049]. Based on this result of an operation, the opening of a cross valve V1 is controlled in the following step S15.
[0050] At step S16, it judges whether the cooling water tubing 17a side opening of a cross valve V1 is 0%, if it is 0%, when ending control of the circulating water flow at the time of dilution operation and having not become 0%, whenever [absorption solution temperature / of a high temperature regenerator 1] is again inputted after return and predetermined time before step S12, and opening control of a cross valve V1 is performed repeatedly.
[0051] the time of whenever [absorption solution temperature / of the high temperature regenerator 1 inputted at step S12] being 95 degrees C or more -- step S13 -- call appearance -- since the cooling water tubing 17a side necessary opening of a cross valve V1 calculates that it is 100% at step S14 based on the control relational expression of drawing 3 the bottom, in step S15, the cooling water tubing 17a side opening of a cross valve V1 is not changed, but 100% of opening is maintained.
[0052] Therefore, in the opening judging in the following step S16, it progresses to the NO side and returns before step S12.
[0053] Thus, since it does not decrease, the circulating water flow which flows into an absorber 5 and condenser 3 side through cooling water tubing 17a in order that the cooling water tubing 17a side opening of a cross valve V1 may not decrease, even if it performs opening control of a cross valve V1 from step S12 to step S16, when whenever [absorption solution temperature / of a high temperature regenerator 1] is 95 degrees C or more is [0054]. Since the temperature of the lean solution which breathes out from an absorber 5 to the dilute solution duct 14, and flows into a high temperature regenerator 1 falls quickly and the elevated-temperature steam has stopped flowing into a high

temperature regenerator 1 moreover, also whenever [absorption solution temperature / of a high temperature regenerator 1] falls promptly.

[0055] It is [0056], when whenever [absorption solution temperature / of a high temperature regenerator 1] falls, for example, it amounts to 92 degrees C, while CLOCK86 repeats control from step S12 to step S16 every 5 seconds based on the time signal sent to every predetermined time (for example, 0.1 seconds). Since it calculates that the cooling water tubing 17a side necessary opening of the cross valve V1 at the time of a step S14 smell lever is 90% and the cooling water tubing 17a side opening of a cross valve V1 is controlled by step S15 to 90%, the amount of the cooling water supplied to an absorber 5 and a condenser 3 through cooling water tubing 17a begins to decrease, and the temperature fall of the lean solution of a high temperature regenerator 1 becomes loose.

[0057] Also in this case, by the opening judging in step S16, since the cooling water tubing 17a side opening of a cross valve V1 is 90%, it progresses to the NO side, and it returns before step S12.

[0058] Similarly it is based on the time signal which CLOCK86 sends. Every [for example,] 5 seconds Carry out by repeating control from step S12 to step S16, and the cooling water tubing 17a side necessary opening of the cross valve V1 based on whenever [absorption solution temperature] is calculated at step S14 each time. The cooling water tubing 17a side opening is dwindled like drawing 3 at step S15, and the amount of the cooling water poured to cooling water tubing 17a which goes via an absorber 5 and a condenser 3 is decreased.

[0059] And while repeating control from step S12 to step S16, when whenever [absorption solution temperature / of a high temperature regenerator 1] falls, for example, it becomes 65 degrees C or less, in order that the cooling water tubing 17a side necessary opening of a cross valve V1 may calculate with 0%, the cooling water tubing 17a side opening is controlled by step S14 to 0% at step S15, and it is [0060]. In order for all the cooling water of the cooling water duct 17 to flow to by-path pipe 17b and not to flow at all to the cooling water tubing 17a side piped by the absorber 5 and the condenser 3, the temperature fall of the lean solution which the temperature fall of the lean solution which breathes out from an absorber 5 to the dilute solution duct 14, and flows into a high temperature regenerator 1 becomes still smaller, therefore is in a high temperature regenerator 1 becomes still looser.

[0061] Thus, if the opening of a cross valve V1 is controlled, it is judged that the opening by the side of cooling water tubing 17a is 0% in the opening judging of the following step S16, it will progress to the near step S17 of YES, and supply control of the cooling water at the time of dilution operation will be completed.

[0062] As explained above, the by-path pipe 17b side opening of a cross valve V1 increases gradually with the temperature fall of the lean solution of a high temperature regenerator 1, the cooling water tubing 17a side opening piped by the absorber 5 and the condenser 3 gradually decreases, and in order that the amount of the cooling water supplied to an absorber 5 and a condenser 3 may balance the temperature fall of the lean solution in a high temperature regenerator 1 and may decrease, there is no concern which causes the lack of dilution and fault dilution.

[0063] In addition, since this invention is not limited to the above-mentioned example, the control relational expression of whenever [absorption solution temperature / of a high temperature regenerator 1], and the opening of a cross valve V1 can be changed suitably, and it is possible to also make different the control relational expression at the time of starting operation and the control relational expression at the time of dilution operation.

[0064]

[Effect of the Invention] In the absorption refrigerator with which this invention uses a steam or warm water for the heat source of a regenerator as explained above Connect to a cooling water duct the by-path pipe which bypasses an absorber and a condenser through a cross valve, and regenerator temperature with the controller which detects and operates The absorber of said cross valve and condenser side opening are made to increase gradually with the rise of regenerator temperature at the time of starting operation of an absorption refrigerator. Since by-path pipe side opening is dwindled, it reboots by short halt. Since regenerator temperature is whenever [low-temperature] when prompt operation is possible, it stops for a long time and it reboots, while cooling water is supplied early and

fault concentration is prevented, when regenerator temperature is high, Time amount until heating effectiveness is high since supply of cooling water is delayed until it reaches predetermined temperature, and it results in a start up is shortened. Moreover, since supply of cooling water increases gradually, there is also an advantage which said that fluctuation of refrigeration capacity was small. On the other hand, the absorber of said cross valve and condenser side opening are dwindled with the fall of regenerator temperature at the time of dilution operation of an absorption refrigerator, and in the absorption refrigerator which makes by-path pipe side opening increase gradually, since the cooling water of the amount corresponding to the fall of regenerator temperature is supplied to an absorber and a condenser, there is no concern which causes the lack of dilution and fault dilution.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The absorption refrigerator characterized by making the absorber of said cross valve, and condenser side opening increase gradually with the rise of regenerator temperature at the time of starting operation of an absorption refrigerator, and dwindling by-path pipe side opening with the controller which connects to a cooling water duct the by-path pipe which bypasses an absorber and a condenser through a cross valve in the absorption refrigerator which uses a steam or warm water for the heat source of a regenerator, detects regenerator temperature, and operates.
[Claim 2] The absorption refrigerator characterized by dwindling the absorber of said cross valve, and condenser side opening with the fall of regenerator temperature at the time of dilution operation of an absorption refrigerator, and making by-path pipe side opening increase gradually with the controller which connects to a cooling water duct the by-path pipe which bypasses an absorber and a condenser through a cross valve in the absorption refrigerator which uses a steam or warm water for the heat source of a regenerator, detects regenerator temperature, and operates.

[Translation done.]

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TITLE: ABSORPTION REFRIGERATING MACHINE

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ABSTRACT:

PURPOSE: To shorten a starting time and prevent the crystallization of an absorbent liquid, regardless of the temperature of a generator, by a method wherein the opening on the side of both an absorber and a condenser of the ports of a three-way valve is gradually increased and the opening on the side of a bypass thereof is gradually decreased according as the temperature of the generator is raised during starting-up operation.

CONSTITUTION: A bypass 17b is connected to a cooling pipe 17 having a cooling water pipe 17a passing an absorber 5 and a condenser 3, through a three-way valve V1. During the starting-up operation of the title machine, the opening on the side of the cooling water pipe 17a of the ports of the three-way valve V1 is gradually increased and the opening on the side of the bypass 17b thereof is gradually decreased by a controller 8, on the basis of the temperature of an absorbent liquid in a high- temperature generator 1, which is detected by a thermal sensor T1. In this way, when the machine is restarted after its short stoppage and temperature of the generator is high, cooling water is quickly supplied, an absorbent liquid is prevented from being highly concentrated, and normal operation can be quickly done. When the machine is restarted after its long stoppage, heating efficiency is heightened and a time until normal operation is done is shortened since the enough supply of cooling water is delayed until the generator reaches a specified temperature.